PATENT
1501-1021

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re application of: Anders HOGLUND et al.

Appl. No.: **NEW** Group:

Filed: March 28, 2002 Examiner:

For: METHOD FOR CONTROLLING A COMBUSTION PROCESS IN A COMBUSTION ENGINE

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, DC 20231

March 28, 2002

Sir:

The following preliminary amendments and remarks are respectfully submitted in connection with the above-identified application.

IN THE CLAIMS:

Please amend the claims as follows:

3. (amended) Method according to Claim 1, characterized in that the gas compressed in the cylinder (2) contains, for an optional quantity of nitrogen oxide emission, a certain proportion of exhaust gases from earlier combustion processes and which have been recirculated to the cylinder in accordance with a variation in the oxygen content from approx. 21% down to approx. 15%.

4. (amended) Method according to claim 1, characterized in that the injection pressure of the fuel feed device (13) is higher than 300 bar, preferably between 1000 and 3000 bar.

5. (amended) Method according to claim 1, characterized in that the injection pressure is controlled such that is varies during the injection of the fuel or the fuel mixture into the cylinder (2).

6. (amended) Method according to claim 1, characterized in that the fuel or the fuel mixture is injected such that the fuel or the fuel mixture, at the start of the injection, is injected at the maximum pressure generated during the whole of the injection.

7. (amended) Method according to claim 1, characterized in that, as a result of the motion and design (29) of the piston (3), kinetic energy is supplied, during the expansion phase, to the large-scale global mixing process.

8. (amended) Method according to claim 1, characterized in that the fuel or the fuel mixture is injected through nozzles of round, elliptical or other suitable shape approx. 0.05-0.40 mm, preferably approx. 0.1-0.25 mm, in size.

9. (amended) Method according to claim 1, characterized in that the injection of the fuel or the fuel mixture into the cylinder (2) is begun, when applied to a combustion engine with crankshaft, at a crankshaft angle of approx. 20° before to approx. 20° after the upper dead centre position.

10. (amended) Method according to claim 1, characterized in that the mixing is carried out locally, since fuel or the fuel mixture and the cylinder gas are mixed in regions upstream of the regions in the spray where combustion takes place and since the injection continues after ignition has been realized.

12. (amended) Method according to claim 1, characterized in that the mixing is carried out globally since essentially the entire quantity of fuel corresponding to one combustion cycle is injected and mixed in the cylinder (2) before ignition and combustion are realized.

13. (amended) Method according to claim 1, characterized in that the gas motion is formed by the gas present in the cylinder (2) being forced out through a gap (21) between the periphery of a piston top (8) and one end of the cylinder (2), when the piston (3) is in the upper dead centre position.

14. (amended) Method according to claim 1, characterized in that a swirl motion is generated in the cylinder (2).

15. (amended) Method according to claim 1, characterized in that further kinetic energy to the mixture is supplied through a post-injection.

REMARKS

Claims 1-15 are pending in the present application.

Entry of the above amendments is earnestly solicited. An early and favorable first action on the merits is earnestly requested.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON

Benoit Castel

Benoit Castel, Reg. No. 35,041

745 South 23rd Street
Arlington, VA 22202
Telephone (703) 521-2297

BC/ia
Attachments

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims have been amended as follows:

3. Method according to ~~either of Claims 1 or 2,~~ Claim 1, characterized in that the gas compressed in the cylinder (2) contains, for an optional quantity of nitrogen oxide emission, a certain proportion of exhaust gases from earlier combustion processes and which have been recirculated to the cylinder in accordance with a variation in the oxygen content from approx. 21% down to approx. 15%.

4. Method according to ~~any of the preceding claims,~~ claim 1, characterized in that the injection pressure of the fuel feed device (13) is higher than 300 bar, preferably between 1000 and 3000 bar.

5. Method according to ~~any of the preceding claims,~~ claim 1, characterized in that the injection pressure is controlled such that is varies during the injection of the fuel or the fuel mixture into the cylinder (2).

6. Method according to ~~any of the preceding claims,~~ claim 1, characterized in that the fuel or the fuel mixture is injected such that the fuel or the fuel mixture, at the start of the injection, is injected at the maximum pressure generated during the whole of the injection.

7. Method according to ~~any of the preceding claims,~~claim 1, characterized in that, as a result of the motion and design (29) of the piston (3), kinetic energy is supplied, during the expansion phase, to the large-scale global mixing process.

8. Method according to ~~any of the preceding claims,~~claim 1, characterized in that the fuel or the fuel mixture is injected through nozzles of round, elliptical or other suitable shape approx. 0.05-0.40 mm, preferably approx. 0.1-0.25 mm, in size.

9. Method according to ~~any of the preceding claims,~~claim 1, characterized in that the injection of the fuel or the fuel mixture into the cylinder (2) is begun, when applied to a combustion engine with crankshaft, at a crankshaft angle of approx. 20° before to approx. 20° after the upper dead centre position.

10. Method according to ~~any of the preceding claims,~~claim 1, characterized in that the mixing is carried out locally, since fuel or the fuel mixture and the cylinder gas are mixed in regions upstream of the regions in the spray where combustion takes place and since the injection continues after ignition has been realized.

12. Method according to ~~any of Claims 1 to 9,~~claim 1, characterized in that the mixing is carried out globally since essentially the entire quantity of fuel corresponding to one combustion cycle is injected and mixed in the cylinder (2) before ignition and combustion are realized.

13. Method according to ~~any of the preceding claims,~~ claim 1, characterized in that the gas motion is formed by the gas present in the cylinder (2) being forced out through a gap (21) between the periphery of a piston top (8) and one end of the cylinder (2), when the piston (3) is in the upper dead centre position.

14. Method according to ~~any of the preceding claims,~~ claim 1, characterized in that a swirl motion is generated in the cylinder (2).

15. Method according to ~~any of the preceding claims,~~ claim 1, characterized in that further kinetic energy to the mixture is supplied through a post-injection.

ABSTRACT OF THE DISCLOSURE

Process which, by spray-controlled, directly injected combustion with the aid of step-by-step technical development of the whole of the combustion system, achieves an intensified mixing process during injection and after-burning, which speeds up soot oxidation during various stages so effectively that the engine can be run with sufficiently high EGR content for desired NOx and soot content down to ultra-low emissions, at the same time as parameters which control the efficiency are decoupled from measures for desired emission level, thereby enabling optimum efficiency to be attained for the process.